

Public Health

Department of Entomology

FLEAS: BIOLOGY AND PUBLIC HEALTH RISK

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Historically, fleas have been involved in devastating epidemics of plague throughout the world. Today in the U. S., fleas primarily are annoying biting pests of pets and people. The most common species is the cat flea, *Ctenocephalides felis*. However, other species of fleas that are parasites of rodents are involved in the transmission of plague and murine typhus, both of which occur in the southwestern U. S (Fig. 1). You are encouraged to learn more about the biology of fleas, especially the cat flea, so that you can make more informed decisions about health risks to you and your pets, how to avoid being bitten, how to prevent or suppress infestations, and whether flea control is warranted in and around your residence.

Is the Cat Flea a Public Health Risk?

Bites of cat fleas can be very annoying to humans because chemicals in flea saliva stimulate an immune response that causes itching. The same immune response can be much more severe in dogs and cats, possibly producing a serious allergic response known as flea bite allergy in susceptible pets. You should take pets suffering from this condition to a veterinarian for treatment and consultation about approaches to flea control.

Cat fleas also are one of the hosts of the double pore dog tapeworm, *Dipylidium caninum*. This tapeworm is a parasite of dogs and cats, but it can infect children who ingest a cat flea in which an immature stage of the tapeworm exists. The immature stage of the tapeworm emerges from the ingested flea and begins to develop in the intestine of the child. This tapeworm does not cause obvious symptoms and is not a cause of serious disease, but you should consult with a physician if an infection is suspected. The most obvious sign of infection in a child is the appearance of a stage of the tapeworm, known as a "proglottid," in a child's bowel movement. A proglottid is whitish, about the size and shape of a pumpkin seed, and capable of undulating movements.

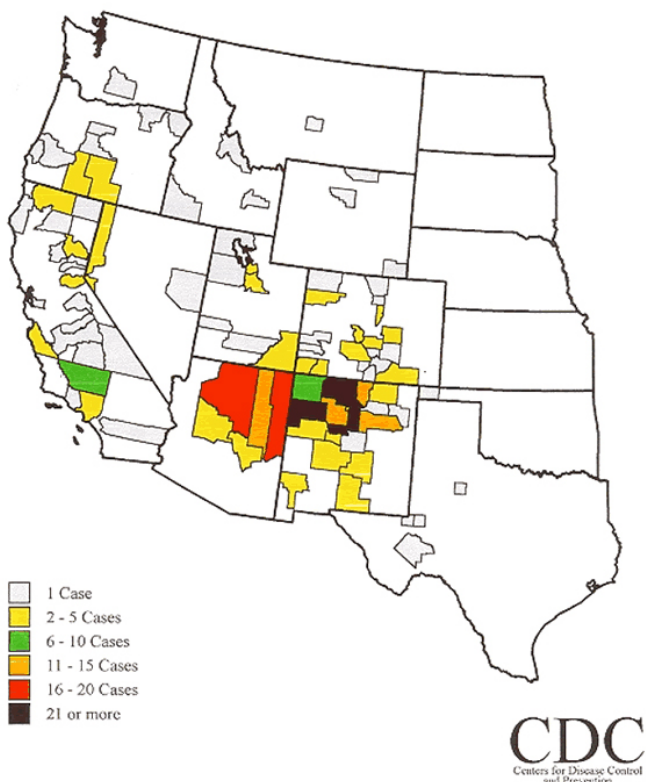


Figure 1. Reported human plague cases by county: U.S., 1970-1997. (Credit: CDC)



Figure 2. Adult cat fleas feeding. (Photo credit: Univar)

Other Fleas That Are A Public Health Risk

The flea that is the most significant risk to human health worldwide is the Oriental rat flea, *Xenopsylla cheopis*. This flea is a parasite of rats in the genus *Rattus*, but also feeds readily on humans and is a highly efficient vector of plague.

A flea of potential importance to vacationers in subtropical and tropical areas is the so-called “chigoe flea,” *Tunga penetrans*. Larvae of this flea develop in sandy soil usually associated with pigs and pig feces. However, chigoe fleas also are found in the sand of coastal beaches, which explains another common name, “sand flea.” Female *T. penetrans* infect people by penetrating into tender flesh between toes or into the soles of the feet. There, the 1-mm long females become embedded, begin to suck blood, and eventually develop eggs. As they do, their body swells about 80-fold, reaching the size of a pea and causing intense pain. Sites of infestation may become infected with bacteria and, if untreated, may eventually require amputation. The best prevention for vacationers is to avoid going barefoot in regions where this flea is common, including on beaches associated with the Caribbean Sea.

How Many Types of Fleas Are There?

There are an estimated 2,500 species of fleas in the world, approximately 325 of which occur in the continental U.S. Over 94% are associated with mammals, and nearly 6% with birds. At least 30 species of fleas have been found on mammals in Indiana, but only the cat flea is a serious pest of pets, livestock, and humans. Despite its common name, the cat flea is the primary flea that infests dogs. A closely related flea with the scientific name *Ctenocephalides canis* (the so-called “dog flea”) exists throughout the world, but is rarely found on pets in Indiana.

How Can I Recognize a Flea?

Adult fleas typically are about 1/8 inch long, oval, and reddish-brown (Fig. 2). They are wingless, and their bodies are very thin, so thin that they can move freely through fur or feathers of their host. They possess very large hind legs that are used for jumping and a very slender proboscis (beak) that extends forward when the flea takes a blood meal. At rest, the proboscis projects downward and backwards between the legs, but it cannot be seen without the aid of a microscope. Similarly, recognition of flea larvae and pupae typically require the use of a microscope. To the unaided eye, the legless larvae resemble tiny whitish “worms.” Flea pupae most likely would not be recognized at all because they are encased within a sticky cocoon covered by incorporated soil particles and small items of debris from the habitat in which the larvae develop.

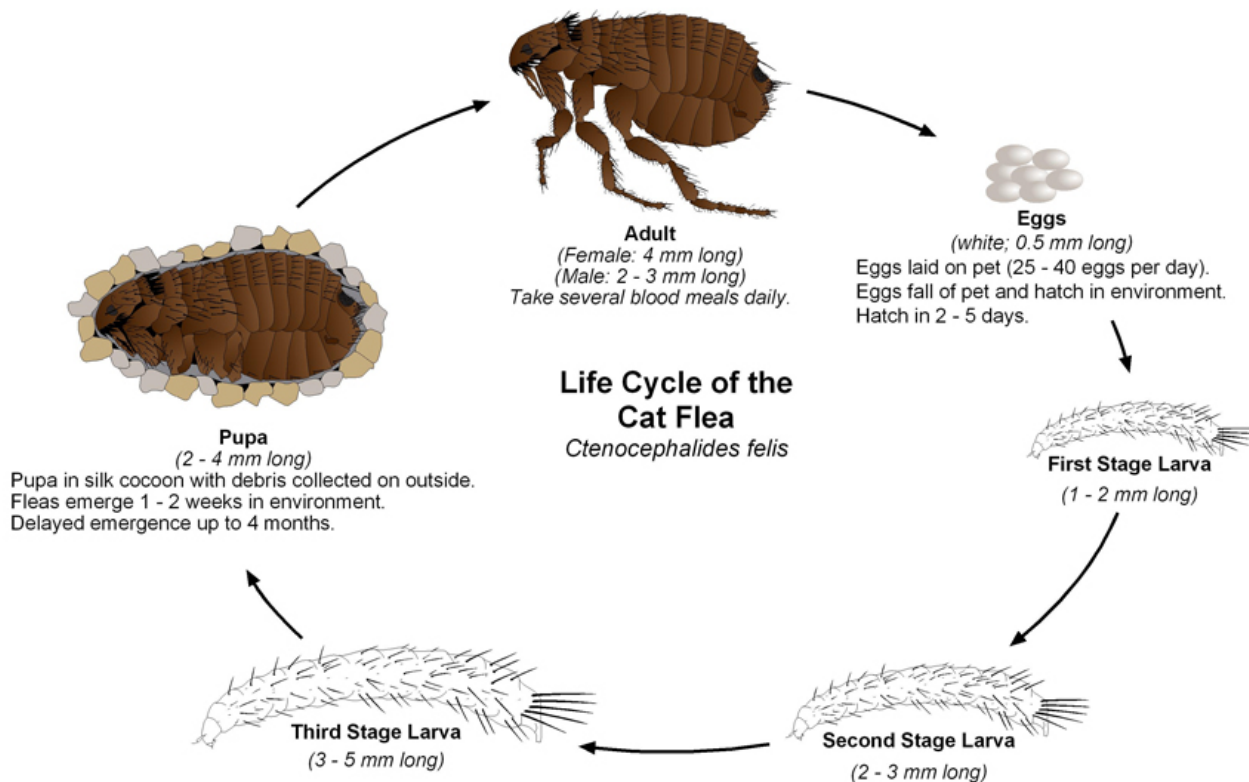


Figure 3. Life cycle of the cat flea. (Drawing credit: Scott Charlesworth, Purdue University, based in part on Elbel, R. E., 1991, IN: *Immature Insects*, Volume 2)

What is the Life Cycle of the Cat Flea In Indiana?

The life cycle presented in Figure 3 is based on the cat flea, which has been studied extensively. Like all fleas, the cat flea develops from egg to adult via a process of “complete metamorphosis.” This process involves the transformation of the last larval stage into a non-feeding pupal stage. Adult males and females live nearly all their lives on a host, and blood sucked from the host is their only food.

Females require blood for the development of eggs, and continue to lay eggs as long as they take blood meals. They are capable of laying 25-40 eggs per day and have the potential to produce about 2,000 eggs in their lifetime. Eggs are laid on a pet, but are not glued to pet hairs. They resemble tiny oval pearls, are relatively heavy, and quickly fall off or are shaken off by the pet. Eggs hatch within 2-5 days under suitable conditions of warm temperature and relatively high humidity. Cat fleas have three larval stages, none of which live or feed on a host.

The three larval stages can be completed in 7-14 days under suitable conditions of temperature, humidity, and availability of food. Cat flea larvae feed on organic matter in or near the resting or sleeping site of an infested pet. They can survive inside dwellings for a few weeks without feeding, but require food before molting into a pupa. Cat flea pupae usually develop into adults in about 1-2 weeks, but can survive for several months inside a dwelling (or outdoors in warm weather) and quickly emerge into adults when stimulated by vibrations produced by an approaching pet or person. Adult cat fleas can survive for weeks indoors without feeding, but egg development does not occur in unfed females. The entire life cycle of cat fleas usually is completed in 21-28 days, and several generations can occur each season, but reproduction typically does not occur during winter in Indiana.

Where Are Cat Flea Larvae and Pupae Found in Homes and Yards?

Cat flea larvae and pupae are found in and around areas where pets are active and where they sleep. Indoors, common sites include pet sleeping mats, among fibers of thick carpets, in upholstered furniture, and on bed covers, if pets are allowed to sleep there. Outdoors, under warm and humid conditions, cat flea larvae and pupae can develop in certain sites where pets frequently rest. One of the most common is in moist, shaded soil beneath shrubs. Another site is in the small amount of soil found in joints of concrete walks and porches.

What Should I Know About the Feeding Habits of Cat Fleas?

Male and female adults feed only on the blood of warm-blooded animals, and they may take as many as 10-15 blood meals per day. Bites on humans usually occur on the ankles and calves. Multiple bites that are more or less in a row are characteristic of repeated feeding by a single flea and not necessarily indicative of an infestation of numerous fleas. Similar to other blood-sucking insects, adult cat fleas respond to carbon dioxide emitted by warm-blooded animals. They also are stimulated by floor vibrations, which cause them to jump and tumble through the air, increasing the possibility of landing on an approaching pet or person. Measurements

reveal that adult cat fleas are capable of jumping upward and outward at least 12 inches.

Cat flea larvae possess chewing mouthparts and feed on particulate matter. Food sources that are especially good for their growth and development include organic debris associated with pet feces and also the feces of adult cat fleas, which contain residues of their digested blood meals.

How Do Pets Become Infested and Pet Owners Get Bitten?

Adult cat fleas usually reside and feed on a single host dog or cat. Pet to pet transfer occurs when pets interact and when they sleep together, but transfer of cat fleas from infested pets to pet owners appears to be uncommon. The usual way in which a human gets bitten by a cat flea is when a “hungry” adult emerges from pupal cocoon and jumps onto a person walking in the vicinity. The presence of flea bites on a person suggests that the home (or a barn) is supporting the development of flea larvae, which can be a continuous source of adult fleas that then infest your pets.

The cat flea also is capable of infesting and feeding on a range of domesticated animals. Common hosts include chickens and livestock, especially calves and pigs. Certain livestock production methods can provide ideal conditions for the development of very large numbers of flea larvae, including those associated with the use of straw that becomes contaminated with livestock urine and feces. Infested barns can be a continual source of adult cat fleas that can infest cats and dogs that sleep in them, and a source of flea bites to people who enter them.

How Do Cat Fleas Survive Winter in Indiana?

Only adult cat fleas appear to be capable of surviving winter in Indiana. Some adults may continue to infest pets during winter, but the most common hosts appear to be wild mammals such as coyotes, raccoons, and opossums. Cat flea eggs, larvae, and pupae are not known to survive winter outdoors and typically are not found indoors during winter.

How Do Humans Influence Cat Fleas?

Pet owners contribute to the success of cat fleas by failing to monitor their pets for the presence of adult fleas and by failing to practice sanitation methods that reduce the development of flea larvae. Again, cat flea larvae and pupae are found in and around areas where pets are active and where they sleep. Owners should keep these areas clean (see below), and periodically launder pet sleeping mats and bed spreads, if pets sleep on them.

What Should I Know about Controlling Cat Fleas?

Effective control of cat fleas can be difficult and complicated, and depends on the conditions in and around homes, yards, and barns that affect the number of flea larvae that develop. An adequate presentation of all the factors pertaining to flea control is beyond the scope of this section. In addition, there are numerous control products containing different chemicals and involving different modes of action that are marketed. Deciding among them can be difficult. We recommend consulting with a veterinarian regarding which product

and approach to use for control of fleas on pets and consulting with a professional pest control company regarding which product and approach to use for control of flea infestations in homes, yards, and barns.

To prepare for such consultations, we encourage reading about the biology of cat fleas and approaches to control in order to make informed decisions regarding the numerous different products and approaches available. The references listed below describe important methods for eliminating or at least reducing the development of flea larvae, including the critical role of vacuuming. You should be aware that various advertised “alternative” control methods and products are of little or no value. For example, controlled scientific studies have shown that ultrasonic devices have no effect on fleas and that products such as brewer’s yeast, B-complex vitamins, and garlic are not effective flea repellents.

Where Can I Find More Information about Fleas, Their Public Health Risk, and Their Control?

The following Web sites contain accurate and detailed information.

- Purdue University <<http://extension.entm.purdue.edu/publications/E-8.pdf>> (See publication E-8-W “Fleas” for information on flea control.)

The following Web site contains accurate and detailed information on fleas of public health risk, including information on plague, murine typhus, and the chigoe flea, *Tunga penetrans*

- Centers for Disease Control and Prevention <<http://www.cdc.gov>>

A recent (2002) textbook by G. Mullen and L. duren, *Medical and Veterinary Entomology*, has an excellent chapter devoted to fleas and flea-borne diseases that covers biology, behavior, medical and veterinary risk, and general information on prevention and control.

READ AND FOLLOW ALL LABEL INSTRUCTIONS. THIS INCLUDES DIRECTIONS FOR USE, PRECAUTIONARY STATEMENTS (HAZARDS TO HUMANS, DOMESTIC ANIMALS, AND ENDANGERED SPECIES), ENVIRONMENTAL HAZARDS, RATES OF APPLICATION, NUMBER OF APPLICATIONS, REENTRY INTERVALS, HARVEST RESTRICTIONS, STORAGE AND DISPOSAL, AND ANY SPECIFIC WARNINGS AND/OR PRECAUTIONS FOR SAFE HANDLING OF THE PESTICIDE.

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